Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for registering and maintaining the data needs, and completing and reviewing the collection of information. Send comments region of information in the data of the control of information in the control of information in the control of information. Send comments for information for informatio	REPORT DO	ΔFRI	L-SR-BL-TR-01-			
### STATEMENTON PARTIES AND ADDRESS 1. REPORT DATE The ABOVE ADDRESS 1. REPORT NUMBER 1. REPORT NU	Public reporting burden for this collection of informatio	n is estimated to average 1 hour per response, in	icluding the time for	re		
1. REPORT DATE (DOMN-YYYY) 28 /11/2000 2. REPORT SAME FINAL REPORT 3. DATES COVERED (From - To) 1/5/99-30/4/00 4. TITLE AND SUBTITLE In situ Absolute Temperature Control of Growing Thin Films of the Complex Oxides Sa. CONTRACT NUMBER 5b. GRANT NUMBER F49620-99-1-0237 5c. PROGRAM ELEMENT NUMBER 6. AUTHOR(S) M. R. Beasley, R. H. Hammond, M. Kelly 5d. PROJECT NUMBER 3/484/US 5f. WORK UNIT NUMBER 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Trustees of the Leland Stanford Junior University 651 Serra Street, Room 260 Stanford, CA 94305-4125 SPONGSORIOMONITORING AGENCY NAME(S) AND ADDRESS(ES) AFOSR/NE 801 N. Randolph Street, Room 732 Arlington, VA 22203-1977 Dr. Harold Weinstock 12. DISTRIBUTION AVAILABILITY STATEMENT Unlimited MODIC OF TRANSMITTAL (TIC. THIS TECHNOLL REPORT NUMBER 13. SUP-LEMENTARY NOTES LAWAFT 190-12. DISTRIBUTION SUMMED. 4. ABSTRACT The Fourier Transform Infrared spectrophotometer purchased from Online Technologies, Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.	of information, including suggestions for reducing this 1215 Jefferson Davis Highway, Suite 1204, Arlington, Paperwork Reduction Project (0704-0188) Washington	burden to Washington Headquarters Service, Din VA 22202-4302, and to the Office of Management of DC 20503.	send comments re- rectorate for Informal int and Budget,	ig: tic	0065	
4. TITLE AND SUBTITLE In situ Absolute Temperature Control of Growing Thin Films of the Complex Oxides 56. GRANT NUMBER F 49620-99-1-0237 56. PROGRAM ELEMENT NUMBER 68. AUTHOR(S) M. R. Beasley, R. H. Hammond, M. Kelly 58. TASK NUMBER 3484/US 58. TASK NUMBER 3484/US 58. TASK NUMBER 3484/US 58. TORK UNIT NUMBER 77. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Trustees of the Leland Stanford Junior University Stanford University 651 Serra Street, Room 260 Stanford, CA 94305-4125 89. SPONSORINGMONITORING AGENCY NAME(S) AND ADDRESS(ES) AFOSR/NE 801 N. Randolph Street, Room 732 Arlington, VA 22203-1977 Dr. Harold Weinstock 12. DISTRIBUTION AVAILABILITY STATEMENT Unlifited MREDECEPTICE OF SCENTER RESEARCH (APOST) MOREOF TRANSMITTAL DID. THIS TECHNOLIA REPORT MREDECEPTION OF RESEARCH (APOST) MOREOF TRANSMITTAL DID. THIS TECHNOLIA REPORT MREDECEPTION OF RESEARCH (APOST) MOREOF TRANSMITTAL DID. THIS TECHNOLIA REPORT MREDECEPTION OF RESEARCH (APOST) MOREOF TRANSMITTAL DID. THIS TECHNOLIA REPORT MREDECEPTION OF RESEARCH (APOST) MOREOF TRANSMITTAL DID. THIS TECHNOLIA REPORT MREDECEPTION OF RESEARCH (APOST) MOREOF TRANSMITTAL DID. THIS TECHNOLIA REPORT MREDECEPTION OF RESEARCH (APOST) MOREOF TRANSMITTAL DID. THIS TECHNOLIA REPORT MREDECEPTION OF RESEARCH (APOST) MOREOF TRANSMITTAL DID. THIS TECHNOLIA REPORT MREDECEPTION OF RESEARCH (APOST) MOREOF TRANSMITTAL DID. THIS TECHNOLIA REPORT MREDECEPTION OF RESEARCH (APOST) MOREOF TRANSMITTAL DID. THIS TECHNOLIA REPORT MREDECEPTION OF RESEARCH (APOST) MOREOF TRANSMITTAL DID. THIS TECHNOLIA REPORT MREDECEPTION OF RESEARCH (APOST) MOREOF TRANSMITTAL DID. THIS TECHNOLIA REPORT MREDECEPTION OF RESEARCH (APOST) MOREOF TRANSMITTAL DID. THIS TECHNOLIA REPORT MREDECEPTION OF TRANSMITTAL DID. THIS TRANSMIT	1. REPORT DATE (DD-MM-YYYY)		PORT			
In situ Absolute Temperature Control of Growing Thin Films of the Complex Oxides 5b. GRANT NUMBER F49620-99-1-0237 5c. PROGRAM ELEMENT NUMBER AUTHOR(S) M. R. Beasley, R. H. Hammond, M. Kelly 5d. PROJECT NUMBER 3484/US 5f. WORK UNIT NUMBER Trustees of the Leland Stanford Junior University Stanford University 65l Serra Street, Room 260 Stanford, CA 94305-4125 SPONSORINGMONITORING AGENCY NAME(S) AND ADDRESS(ES) AFOSK/NE 80l N. Randolph Street, Room 732 Arlington, VA 22203-1977 Dr. Harold Weinstock 2. DISTRIBUTION AVAILABILITY STATEMENT Unlirited AIR FORCE OF TRANSMITTAL JUIC. THIS TECHNICAL REPORT HAS BEEN REVISION AND IS PROVIDED OR PUBLIC REFASE LAWAFR 19042. DISTRIBUTION IS UNLIMITED. 4. ABSTRACT The Fourier Transform Infrared spectrophotometer purchased from Online Technologies, Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.				IES CON		
Growing Thin Films of the Complex Oxides So. Grant Number				Sa. CON	ATRACT NUMBER	
F49620-99-1-0237 5c. PROGRAM ELEMENT NUMBER AUTHOR(S) M. R. Beasley, R. H. Hammond, M. Kelly Se. TASK NUMBER 3484/US 5f. WORK UNIT NUMBER Trustees of the Leland Stanford Junior University Stanford University 65l Serra Street, Room 260 Stanford, CA 94305-4125 SPONSORINGMONITORING AGENCY NAME(S) AND ADDRESS(ES) AFOSR/NE 80l N. Randolph Street, Room 732 Arlington, VA 22203-1977 Dr. Harold Weinstock 2. DISTRIBUTION AVAILABILITY STATEMENT Unlifited ARFONCECTFICE OF SCIENTIFIC RESEARCH (AFOSR) MOTICE OF TRANSMITTAL DTIC. THIS TECHNICAL REPORT HAS BEEN REVIEWED AND BE REPORTED FOR PUBLIC RELEASE LAWAFR 199-12. DISTRIBUTION IS UNLIMITED. 4. ABSTRACT The Fourier Transform Infrared spectrophotometer purchased from Online Technologies, Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.				5h GRA	ANT NUMBER	
5c. PROGRAM ELEMENT NUMBER 5d. PROJECT NUMBER 3484/US 5f. WORK UNIT NUMBER 4. PEPFORMING ORGANIZATION REPORT NUMBER 10. SPONSOR/MONITOR'S ACRONYM'S ACRONY	Growing Thin Films of the Complex Oxides					
M. R. Beasley, R. H. Hammond, M. Kelly 50. TASK NUMBER 3484/US 51. WORK UNIT NUMBER PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Trustees of the Leland Stanford Junior University Stanford University 651 Serra Street, Room 260 Stanford, CA 94305-4125 SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) AFOSR/NE 801 N. Randolph Street, Room 732 Arlington, VA 22203-1977 Dr. Harold Weinstock 2. DISTRIBUTION AVAILABILITY STATEMENT Unligited AREPORTE OFFICE OF SCIENTIFIC RESEARCH (AFOSR) NOTICE OF TRANSMITTAL OTIC. THIS TECHNICAL REPORT HAS BEEN REVIEWED AND IS APPROVED FOR PUBLIC RELEASE LAWAFR 1904.2 DISTRIBUTION IS UNLIMITED. 4. ABSTRACT The Fourier Transform Infrared spectrophotometer purchased from Online Technologies, Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.						
M. R. Beasley, R. H. Hammond, M. Kelly 56. TASK NUMBER 3484/US 57. WORK UNIT NUMBER 3484/US 58. WORK UNIT NUMBER 3484/US 59. WORK UNIT NUMBER 3484/US 59. WORK UNIT NUMBER 80. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Trustees of the Leland Stanford Junior University Stanford University 651 Serra Street, Room 260 Stanford, CA 94305–4125 59. SPONSORINGMONITORING AGENCY NAME(S) AND ADDRESS(ES) AFOSR/NE 801 N. Randolph Street, Room 732 Arlington, VA 22203–1977 Dr. Harold Weinstock 20. DISTRIBUTION AVAILABILITY STATEMENT Unlifited ARRONZE OFFICE OF SCIENTIFIC RESEARCH (AFOSR) NOTICE OF TRANSMITTAL OTIC. THIS TECHNICAL REPORT HAS SEEN REVIEWED AND IS APPROVED FOR PUBLIC RELEASE LAWAFR 190-12. DISTRIBUTION IS UNLIMITED. 4. ABSTRACT The Fourier Transform Infrared spectrophotometer purchased from Online Technologies, Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.					ordan Element Nomber	
Se. TASK NUMBER 3484/US St. WORK UNIT NUMBER	. AUTHOR(S)			5d. PRC	DJECT NUMBER	
PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Trustees of the Leland Stanford Junior University Stanford University 651 Serra Street, Room 260 Stanford, CA 94305-4125 SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) AFOSK/NE 801 N. Randolph Street, Room 732 Arlington, VA 22203-1977 Dr. Harold Weinstock 2. DISTRIBUTION AVAILABILITY STATEMENT Unlimited ARFORCE OFFICE OF SCIENTIFIC RESEARCH (AFOSR) Unlimited ARFORDE OFFICE OF SCIENTIFIC RESEARCH (AFOSR) NOTICE OF TRANSMITTAL DITC. THIS TECHNICAL REPORT HAS BEEN REVIEWED AND IS APPROVED FOR PUBLIC RELEASE LAWAFR 180-12. DISTRIBUTION IS UNLIMITED. 4. ABSTRACT The Fourier Transform Infrared spectrophotometer purchased from Online Technologies, Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.						
PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Trustees of the Leland Stanford Junior University Stanford University 651 Serra Street, Room 260 Stanford, CA 94305-4125 SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) AFOSR/NE 801 N. Randolph Street, Room 732 Arlington, VA 22203-1977 Dr. Harold Weinstock 2. DISTRIBUTION AVAILABILITY STATEMENT Unlimited ARFONCE OF TRANSMITTAL UTIC. THIS TECHNICAL REPORT HAS BEEN REVIEWED AND IS APPROVED FOR PUBLIC RELEASE LAWAFR 190-12. DISTRIBUTION IS UNLIMITED. 4. ABSTRACT The Fourier Transform Infrared spectrophotometer purchased from Online Technologies, Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.	·	•		5e. TAS		
PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Trustees of the Leland Stanford Junior University Stanford University 651 Serra Street, Room 260 Stanford, CA 94305-4125 SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) AFOSR/NE 801 N. Randolph Street, Room 732 Arlington, VA 22203-1977 Dr. Harold Weinstock 2. DISTRIBUTION AVAILABILITY STATEMENT Unlimited ARFONCE OFFICE OF SCIENTIFIC RESEARCH (AFOSR) NOTICE OF TRANSMITTAL UTIC. THIS TECHNICAL REPORT HAS BEEN REVIEWED AND IS APPROVED FOR PUBLIC RELEASE LAWAFR 190-12. DISTRIBUTION IS UNLIMITED. 4. ABSTRACT The Fourier Transform Infrared spectrophotometer purchased from Online Technologies, Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.					3484/US	
Trustees of the Leland Stanford Junior University Stanford University 651 Serra Street, Room 260 Stanford, CA 94305-4125 SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) AFOSR/NE 801 N. Randolph Street, Room 732 Arlington, VA 22203-1977 Dr. Harold Weinstock 2. DISTRIBUTION AVAILABILITY STATEMENT Unlighted MOTICE OF TRANSMITTAL DITC. THIS TECHNICAL REPORT HAS BEEN REVIEWED AND IS APPROVED FOR PUBLIC RELEASE LAW AFR 190-12. DISTRIBUTION IS UNLIMITED. 4. ABSTRACT The Fourier Transform Infrared spectrophotometer purchased from Online Technologies, Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.	•			5f. WOR	RK UNIT NUMBER	
Trustees of the Leland Stanford Junior University Stanford University 651 Serra Street, Room 260 Stanford, CA 94305-4125 SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) AFOSR/NE 801 N. Randolph Street, Room 732 Arlington, VA 22203-1977 Dr. Harold Weinstock 2. DISTRIBUTION AVAILABILITY STATEMENT Unlimited AIR FONCE OF TRANSMITTAL DITC. THIS TECHNICAL REPORT HAS BEEN REVIEWED AND IS APPROVED FOR PUBLIC RELEASE LAW AFR 190-12. DISTRIBUTION IS UNLIMITED. 4. ABSTRACT The Fourier Transform Infrared spectrophotometer purchased from Online Technologies, Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.	DEDECTRING ODG ANIZATION MAI	AEIC) AND ADDDEEC(EC)			DEDECOMING ODGANIZATION	
Stanford University 651 Serra Street, Room 260 Stanford, CA 94305-4125 SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) AFOSR/NE 801 N. Randolph Street, Room 732 Arlington, VA 22203-1977 Dr. Harold Weinstock 2. DISTRIBUTION AVAILABILITY STATEMENT Unlimited AR FONCE OFFICE OF SCIENTIFIC RESEARCH (AFOSR) NOTICE OF TRANSMITTAL DITC. THIS TECHNICAL REPORT HAS BEEN REVIEWED AND IS APPROVED FOR PUBLIC RELEASE LAW AFR 190-12. DISTRIBUTION IS UNLIMITED. 4. ABSTRACT The Fourier Transform Infrared spectrophotometer purchased from Online Technologies, Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.			vercity		1	
651 Serra Street, Room 260 Stanford, CA 94305–4125 SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) AFOSR/NE 801 N. Randolph Street, Room 732 Arlington, VA 22203–1977 Dr. Harold Weinstock 2. DISTRIBUTION AVAILABILITY STATEMENT Unlimited MR FORCE OFFICE OF SCIENTIFIC RESEARCH (AFOSR) NOTICE OF TRANSMITTAL DITC. THIS TECHNICAL REPORT HAS BEEN REVIEWED AND IS APPROVED FOR PUBLIC RELEASE LAW AFR 190-12. DISTRIBUTION IS UNLIMITED. 4. ABSTRACT The Fourier Transform Infrared spectrophotometer purchased from Online Technologies, Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.		· · · · · · · · · · · · · · · · · · ·	versity			
Stanford, CA 94305–4125 SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) AFOSR/NE 801 N. Randolph Street, Room 732 Arlington, VA 22203–1977 Dr. Harold Weinstock 2. DISTRIBUTION AVAILABILITY STATEMENT Unlimited MOTICE OF TRANSMITTAL DITIO. THIS TECHNICAL REPORT HAS BEEN REVIEWED AND IS APPROVED FOR PUBLIC RELEASE LAW AFR 190-12. DISTRIBUTION IS UNLIMITED. 4. ABSTRACT The Fourier Transform Infrared spectrophotometer purchased from Online Technologies, Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.	•	m 260				
AFOSR/NE 801 N. Randolph Street, Room 732 Arlington, VA 22203-1977 Dr. Harold Weinstock 2. DISTRIBUTION AVAILABILITY STATEMENT Unlighted AR FORCE OFFICE OF SCIENTIFIC RESEARCH (AFOSR) NOTICE OF TRANSMITTAL DITC. THIS TECHNICAL REPORT HAS BEEN REVIEWED AND IS APPROVED FOR PUBLIC RELEASE LAWAFR 190-12. DISTRIBUTION IS UNLIMITED. 4. ABSTRACT The Fourier Transform Infrared spectrophotometer purchased from Online Technologies, Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.	· ·					
Arlington, VA 22203-1977 Dr. Harold Weinstock 2. DISTRIBUTION AVAILABILITY STATEMENT Unlimited AIR FORCE OFFICE OF SCIENTIFIC RESEARCH (AFOSR) NOTICE OF TRANSMITTAL DITC. THIS TECHNICAL REPORT HAS BEEN REVIEWED AND IS APPROVED FOR PUBLIC RELEASE LAW AFR 190-12. DISTRIBUTION IS UNLIMITED. 4. ABSTRACT The Fourier Transform Infrared spectrophotometer purchased from Online Technologies, Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.	. SPONSORING/MONITORING AGEN	CY NAME(S) AND ADDRESS(ES)			10. SPONSOR/MONITOR'S ACRONYM(S)	
Arlington, VA 22203-1977 Dr. Harold Weinstock 2. DISTRIBUTION AVAILABILITY STATEMENT Unlighted AIR FORCE OFFICE OF SCIENTIFIC RESEARCH (AFOSR) NOTICE OF TRANSMITTAL DITC. THIS TECHNICAL REPORT HAS BEEN REVIEWED AND IS APPROVED FOR PUBLIC RELEASE LAWAFR 190-12. DISTRIBUTION IS UNLIMITED. 4. ABSTRACT The Fourier Transform Infrared spectrophotometer purchased from Online Technologies, Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.	•					
Dr. Harold Weinstock 2. DISTRIBUTION AVAILABILITY STATEMENT Unlimited AIR FORCE OFFICE OF SCIENTIFIC RESEARCH (AFOSR) NOTICE OF TRANSMITTAL DITC. THIS TECHNICAL REPORT HAS BEEN REVIEWED AND IS APPROVED FOR PUBLIC RELEASE LAW AFR 190-12. DISTRIBUTION IS UNLIMITED. 4. ABSTRACT The Fourier Transform Infrared spectrophotometer purchased from Online Technologies, Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.					11. SPONSORING/MONITORING	
2. DISTRIBUTION AVAILABILITY STATEMENT Unlighted NOTICE OF TRANSMITTAL DTIC. THIS TECHNICAL REPORT HAS BEEN REVIEWED AND IS APPROVED FOR PUBLIC RELEASE LAW AFR 190-12. DISTRIBUTION IS UNLIMITED. 4. ABSTRACT The Fourier Transform Infrared spectrophotometer purchased from Online Technologies, Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.	Arlington, VA 22203-1	977			AGENCY REPORT NUMBER	
Unlimited NOTICE OF TRANSMITTAL DITC. THIS TECHNICAL REPORT HAS BEEN REVIEWED AND IS APPROVED FOR PUBLIC RELEASE LAW AFR 190-12. DISTRIBUTION IS UNLIMITED. 4. ABSTRACT The Fourier Transform Infrared spectrophotometer purchased from Online Technologies, Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.						
NOTICE OF TRANSMITTAL DTIC. THIS TECHNICAL REPORT HAS BEEN REVIEWED AND IS APPROVED FOR PUBLIC RELEASE LAW AFR 190-12. DISTRIBUTION IS UNLIMITED. 4. ABSTRACT The Fourier Transform Infrared spectrophotometer purchased from Online Technologies, Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.	2. DISTRIBUTION AVAILABILITY STA	TEMENT	AIR FORCE OF	FICE OF SCI	IENTIFIC RESEARCH (AFOSR)	
The Fourier Transform Infrared spectrophotometer purchased from Online Technologies, Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.	Unlimited			TICE OF TRANSMITTAL DTIC. THIS TECHNICAL REPORT		
The Fourier Transform Infrared spectrophotometer purchased from Online Technologies, Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.			HAS BEEN REVIEWED AND IS APPROVED FOR PUBLIC RELEASE			
The Fourier Transform Infrared spectrophotometer purchased from Online Technologies, Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.	13. SUPPLEMENTARY NOTES LAWAFR		LAW AFR 190-1	12. Distrib	UTION IS UNLIMITED.	
The Fourier Transform Infrared spectrophotometer purchased from Online Technologies, Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.						
Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.	4. ABSTRACT		.		from Online Technologies, esigner from that company.	
Inc. was tested and declared operational with the help of the designer from that company. Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.	The Fourier Trans	form Infrared spectrophoto	meter puro	chased t	from Online Technologies	
Bench top tests of the sensitivity of the temperature measurement to spectral reflection and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.	Inc. was tested and	d declared operational with	the help o	f the de	esigner from that company	
and angle of acceptance were performed. Design and structural modifications were made to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.	Bench top tests of	the sensitivity of the tempo	erature me	asurem	ent to spectral reflection	
to the electron beam evaporator in which it will be used. These are necessary to accommodate the special requirements of the instrument.	and angle of accen	tance were performed. Dec	sign and et	ructural		
accommodate the special requirements of the instrument.	to the electron bea	m evaporator in which it u	vill he used	These	e are necessary to	
•	accommodate the	mecial requirements of the	inctrimon	. IIIÇS(are necessary to	
5. SUBJECT TERMS	accommodate the	special requirements of the	, monumen	н.		
5. SUBJECT TERMS						
	5. SUBJECT TERMS			,		

Fourier transform infrared (FTIR), temperature measurement, reflection, angle of acceptance.

16. SECURITY CLASSIFICATION OF:			18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON	
a. REPORT	b. ABSTRACT	c. THIS PAGE	ABSTRACT	OF FAGES	M.R. Beasley
u nd	lassified		unlimited	3	19b. TELEPONE NUMBER (Include area code) 650-723-1196

Final Report

to the Air Force Office of Scientific Research

for a program in

In situ Absolute Temperature Control of Growing Thin Films of the Complex Oxides

Grant No. AF49620-99-1-0237

for the period 1 May 1999 to 30 April 2000

Principal Investigator: Professor Malcolm R. Beasley

Co-Investigators: T.M. Gur, R.H. Hammond and M. Kelly

Collaborator: P. Rosenthal, On-Line Technologies

Center for Materials Research Stanford University Stanford, CA 94305

November 2000

Final Report

In situ Absolute Temperature Control of Growing Thin Films of the Complex Oxides

This contract was for the purchase and commissioning of a Fourier Transform Infrared (FTIR) spectrophotometer capable of determining *in situ* the absolute temperature of a growing high temperature superconductor thin film. Such measurement has not been accomplished heretofore and is thought to be critical for achieving good control of the growth process.

The FTIR thin film monitor was delivered by On-Line Technologies, Inc., in May 2000. On May 9 and 10, 2000, the designer-engineer of this instrument, Jiazhan Xu, arrived from Connecticut to install it and instruct the Stanford students and postdoctoral researchers in its operation. He was assisted by the local representative, Dr. Matt Richter.

The original installation was on a bench top with a test sample heated by a hotplate. The infrared source and spectrometer were located at distances and angles with respect to the sample that approximated those expected in actual application. Using a known sample, a silicon wafer, with a known emissivity, the instrument was calibrated and checked through a range of temperatures. After several postdoctoral researchers and students learned to use the instrument, it was declared operational.

One fact, of its operation is that spectral reflection of the infrared light off the sample into the spectrometer is assumed in determining the emissivity. This could be a problem in its practical application since growing films are not necessarily sufficiently smooth—i.e., roughness can develop. Another factor is the angle of the sample required to reflect into the spectrometer's axis of acceptability. A test protocol was developed to explore these issues. Samples of different roughness were selected, again on the bench set up, and a hotplate used to vary the temperature. These tests were conducted by an undergraduate student employed for the summer, supervised by Professor Mike Kelly. A qualitative understanding of this issue was achieved.

The first actual use of this instrument will be in the electron beam evaporator used for high temperature superconducting YBCO coated conductor research. This will be very important, because it is believed that the temperature of the deposit, including a possible liquid stage, is vital in controlling the growth of high Jc YBCO. The evaporator bell jar top has had special ports installed to allow the FTIR to see the substrate, and is now being installed in the new Geballe Laboratory for Advanced Materials at Stanford. It will soon be in operation.